	Reg. No.:	
	Name :	

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MID TERM EXAMINATIONS – November 2024

Programme	:	**B.Tech.**	Semester	:	**Interim Semester 2024-25**
Course Title	:	**Design and Analysis of Algorithms**	Course Code	:	**CSE3004**
Date/Session	:	**13.11.2024/ Wednesday & Session I**	Slot	:	**B11+B12+B13**
Time	:	**1 ½ hours**	Max. Marks	:	**50**

Answer all the Questions

Q.No.	Sub. Sec.	Question Description	Marks
1		Describe the concept of a recursive relation with example and its significance in algorithm analysis. Solve the following recursive relation step-by-step using the Substitution Method, Master Method. $T(n)=3T(n/2)+n$	**10**
2		Discuss the complexity classes P and NP, their significance in computational theory, and the relationship between them. Explain the concept of NP-completeness and its relevance to the P vs NP problem, provide examples of problems in each class, and discuss the importance of understanding these complexity classes in practical applications.	**10**
3		Consider a **Fractional Knapsack Problem** where you have the following items: • **Item 1**: Value = 60, Weight = 10 • **Item 2**: Value = 100, Weight = 20 • **Item 3**: Value = 120, Weight = 30 The capacity of the knapsack is **50**. Using the **Greedy Method**, solve this problem step by step. Specifically: 1. Calculate the **value-to-weight ratio** for each item. 2. Show how the algorithm selects items based on this ratio. 3. Illustrate how the items (or fractions of items) are added to the knapsack. 4. Calculate the **total value** of the items in the knapsack at the end of the process. Discuss the significance of the **greedy choice property** and the **algorithm's time complexity**.	**10**
4		Solve the **N-Queen problem** for N=4 using the **backtracking method**. Walk through the process step by step, starting from placing the first queen and proceeding row by row, using backtracking when necessary. Additionally, the time complexity of the backtracking algorithm for this problem will be discussed.	**10**

5		Consider a sequence of 4 matrices with the following dimensions: • $A_1(10 \times 20)$ • $A_2(20 \times 30)$ • $A_3(30 \times 40)$ • $A_4(40 \times 50)$ Using **dynamic programming**, demonstrate how to compute the **minimum number of scalar multiplications** needed to multiply these matrices. Show the step-by-step process of filling out the **cost matrix** and, explain how the algorithm arrives at the optimal solution and discuss the **time complexity** of the dynamic programming approach for matrix chain multiplication.	**10**

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